

COMMON SYSTEMS
CABLE AND WIRE INSTALLATION AND REMOVAL REQUIREMENTS
CABLE RACKS AND RACEWAYS

Contents	Page		
1. GENERAL	1		
Reason For Reissue	1	4. UNSECURED CABLE	7
2. ROUTING AND PLACEMENT	1	5. SECURED CABLE	7
A. General	1	A. General	7
B. Central Office Ground Cable ...	3	B. Securing With Twine	7
C. Power Cable	3	Copper Cable In General	8
D. Fiber Optic Cable	3	Power Cable	8
Entrance Cable	3	Fiber Optic Cable	8
Interconnecting Cable	4	C. Securing With Nylon Cable	
E. Coaxial Cable	4	Ties	8
F. Through Cable Openings	4	6. PROTECTION	9
G. Through Circular Openings ...	4	7. CABLE REMOVAL	10
3. SUPPORTING	5	8. REFERENCE	10
A. General	5		
Straight Vertical Runs	6		
Cable Rack Spirals	6		
B. Power Cable	6		

1. GENERAL

1.01 This section provides the guidelines for placing, supporting, securing, and removing cable and wire in SBC local exchange carrier network facilities. The word CABLE as used in this section refers to cable and wire products commonly used in network facilities. The word WIRE is only used where a clear distinction from cable is appropriate. Refer to MS003-150 for the provisioning of hardware items referenced in this section.

Reason For Reissue

1.02 This section was reissued to change title; add MS003-150 reference in 1.01; revise figures 2, 5, 6, and 7 to reflect solid stringer cable racks; delete Figures 8, 9, 10, 14 which have been incorporated into 800-006-150MP and 800-006-151MP.

2. ROUTING AND PLACEMENT

A. General

2.01 Cable shall be installed on or in cable racks and raceways designated for the type of cable being installed, and shall follow the cable routing paths provided in the associated job engineering or installation documentation. Except as discussed in 2.02, 2.03, 2.06, and 2.07 cable routes shall be engineered using the most direct path possible between points of termination.

ISS. B, SECTION 800-003-150MP

2.02 Cable congestion in office cable racks shall be avoided. When large amounts of cable are to be installed, cable shall be routed using more than one cable rack path to avoid unnecessary cable pileup or blockage of any single cable path. For new cable rack runs, additional or alternate cable routes should be used when approximately 75% of the cable rack's available cable capacity is consumed. The following guidelines shall be used to determine when additional cable paths should be used when determining cable routes for existing cable rack runs:

- (a) When the cable pileup has been increased by 2 inches.
- (b) When approximately 225 cables having an approximate 3/8" diameter have been run.
- (c) When approximately 20% of the available cable space has been used.

2.03 Cable terminating on office distributing frames shall be routed to the distributing frame using office cross aisle cable racks located nearest the apparatus on which the cable will terminate.

2.04 Excess cable shall not be stored on or in office cable racks. Except for the reasons provided below excess cable shall be removed from individual cable runs, or the excessively long cable runs shall be replaced with cable runs of the appropriate length. For the purposes of this requirement a cable is considered excessively long if more than 6 feet of its length will have to be placed or otherwise stored on or in office cable racks. Excessively long cable runs do not have to be replaced or cut and reconnected:

- (a) When the excess cable is required for proper equipment operation such as signal balancing or equipment sequencing. The excess cable shall be distributed in a back and forth fashion along cable racks so the resulting pileup is not concentrated at a single location.
- (b) When the excess cable is associated with equipment that is located in a temporary location, and the cable will be used when the equipment is moved to its ultimate location. The cable shall be coiled, banded, identified, and securely attached to overhead cable racks in a manner that will prevent it from becoming buried by subsequent cable installation activity.
- (c) When the excess cable is placed in cable storage apparatus located in other than the equipment overhead environment.

2.05 For the reasons given in 2.04 cables shall be run from connectorized equipment to non connectorized equipment. Double ended connector cables shall be run from non switching equipment network elements to switching equipment frames. This is to insure that cable pileups caused by permissible excess cable lengths will be located in the lineup cable troughs of switching equipment where less cable installation activity is anticipated.

2.06 Cable pileup on vertical racks other than power racks shall be limited so that it is not closer than 3 inches to the interior face of cable holes. Cable pileup on vertical power cable racks shall be limited to 7 inches regardless of cable hole size.

2.07 Cable routes should be engineered to minimize the number of cable holes to be opened when appropriate. Generally, it is more economical to increase the total amount of switchboard type cable being installed by 75 feet (30 feet for power cable) to avoid opening another cable hole. This guideline should be used with 2.04(a) to (c) when determining the need to use additional cable routes.

Example: For a switchboard cable run consisting of 5 cables, it is more economical to increase the length of each cable being run by 15 feet to avoid opening an additional cable hole. (15 cable feet x 5 cables = 75 feet).

- 2.08 Cable holes shall be firestopped at the completion of cable installation or removal activity for a given day or work shift.
- 2.09 Cable made inoperative by work operations shall be removed from office cable racks in accordance with part 7 of this section.

B. Central Office Ground Cable

- 2.10 Central office (CO) ground conductors shall be run in an exposed manner that provides for visual inspection of the entire ground system and access to all cable connectors. Horizontal runs shall be supported along the side or underneath runs of cable rack, or from auxiliary framing. Conductor support shall be obtained by the use of clips, brackets or similar devices that do not form a closed metallic ring around CO ground conductors, and/or by securing cable directly to the sides of cable rack stringers or auxiliary framing channels.
- 2.11 CO ground conductors shall be run through floors and walls in short sections of PVC or fibrous pipe. Supports and sleeves provided for the routing of CO ground conductors shall not be used for the routing of any other types of cable.
- 2.12 In general, the routing and support requirements for power cable also apply to CO ground conductors. One exception is that the requirement to provide a minimum of 20 feet of horizontal cable support at every third floor for vertical runs, does not apply to CO ground conductors. CO ground conductors shall be routed between their points of termination using the most direct route practicable.

C. Power Cable

- 2.13 Primary dc power distribution cable within the office power plant area, and between the office power plant and the first power distribution point of network equipment shall be run secured on cable racks dedicated to power conductors. Secondary dc power distribution leads within the common or facilities equipment areas may be run on or in the cable racks used for miscellaneous signaling (switchboard) cable. Secondary dc power distribution leads within the cable distribution system of a network switching system shall be installed in accordance with the cable and wire installation documentation associated with the switching system, unless otherwise specified.

Note: Secondary dc distribution leads should be installed in the "power" portion of compartmentalized type cable racks whenever possible.

- 2.14 Unfused battery leads and their accompanying battery return leads, such as those between the batteries and battery control and distribution bays, shall not be run on a rack with any other type of cable.

D. Fiber Optic Cable

Entrance Cable

- 2.15 For the purposes of this part, fiber optic entrance cable is that portion of the "loop" that is installed between a building's cable entrance facility and the office fiber distribution frame. Fiber optic entrance cable shall be installed on or in dedicated cable racks or raceways to prevent burial by other cable. Beyond the cable entrance facility, entrance cable that is listed or otherwise rated as being resistant to the spread of fire may be run secured on ladder type cable rack in accordance with PBS-D-ED-6601 and PBS-D-ED-6602.

ISS. B, SECTION 800-003-150MP

2.16 Entrance cable that is not listed as being resistive to the spread of fire shall be installed in rigid conduit or intermediate metal conduit in accordance with Section 770-50 of the National Electrical Code according to the type of fiber optic cable being installed.

Note: Exception 1 to the National Electrical Code Section 770-50 permits unlisted cable if its run length is 50' or less, measured from the cable entrance facility, and the cable terminates in a terminal box.

Interconnecting Cable

2.17 Unless otherwise specified by product specific application guidelines, fiber optic interconnecting cable (jumpers) shall be run in dedicated raceways or a dedicated portion of compartmentalized cable racks. Enclosed cable raceways such as square and rectangular ducts and conduits shall be stamped or otherwise labeled to indicate their restrictive application.

2.18 To avoid the premature exhaustion of available cable space, excess cable of individual fiber optic cable runs shall not be stored on or in fiber optic raceways. All excess cable shall be stored in slack storage panels installed in equipment frameworks, or on slack storage reels mounted to the office overhead ironwork.

E. Coaxial Cable

2.19 Unless otherwise specified by product specific application guidelines, coaxial cables may be run with miscellaneous signaling (switchboard) cable.

F. Through Cable Openings

2.20 All cable runs passing through fire rated floors and walls shall be smokestopped to restrict the spread of smoke during a fire.

G. Through Circular Openings

2.21 Table A provides the guidelines for the number of cables permitted in circular and small rectangular openings that will be fire stopped with intumescent putty fire stopping products. The maximum number of cables listed is based on product performance guidelines of 28% maximum fill of PVC jacketed cables per opening.

TABLE A									
Permissible Penetrating Items In Circular and Small Rectangular Openings For Intumescent Fire Stopping Applications									
Opening Size	Maximum Number Of Cables In Opening Cable Diameter (In.)								Minimum Trade Size Of Pipe in Opening (Steel Or Aluminum)
	1/4	1/2	3/4	1	1-1/2	2	2-1/2	3	
2" dia.	17	4	1	1					1/2"
3" dia.	40	10	4	2	1				1-1/4"
4" dia.	71	17	8	4	2	1			2-1/2"
5" dia.	112	28	12	7	3	2	1		3"
6" dia.	161	40	18	10	4	2	1	1	4"
4" x 6"	137	34	15	8	3	2	1	1	-

2.22 Table B provides the guidelines for the number of cables permitted in circular and small rectangular openings that will be fire stopped with expandable foam fire stopping products.

The maximum number of cables listed is based on product performance guidelines of 40% maximum fill of PVC jacketed cables per opening.

TABLE B								
Permissible Penetrating Items In Circular and Small Rectangular Openings For Expandable Foam Applications								
Opening Size	Maximum Number Of Cables In Opening Cable Diameter (In.)							
	1/4	1/2	3/4	1	1-1/2	2	2-1/2	3
2" dia.	25	6	2	1				
3" dia.	57	14	6	3	1			
4" dia.	102	25	11	6	2	1		
5" dia.	160	40	17	10	4	2	1	
6" dia.	230	57	25	14	6	3	2	1
4" x 6"	195	48	21	12	5	3	1	1

3. SUPPORTING

A. General

3.01 All cable shall be placed and securely supported so there is no appreciable sag in the cabling, or undue strain on skinners, connectors, or terminating apparatus. In general, cable shall not be unsupported for a distance greater than 3 feet when measured along the shortest cable between the last point of support on a cable rack and the first point of support on an equipment frame or other apparatus except as follows:

- Where a cable to a distributing frame passes through a floor opening immediately below the frame an supported length of 4 feet is permissible.
- Cable entering a distributing frame from a cable rack at the top of the frame may be unsupported for a distance of 4 feet.
- Vertical cables in floor openings do not require support within the opening.

3.02 Cables that are unsupported for a distance greater than 2 feet between office cable racks and the first point of support within an equipment frame shall be banded together at a minimum of three locations to keep the cables organized. For cable lengths less than 2 feet, banding shall be applied only if necessary to keep the cables grouped together in an orderly fashion as illustrated in Fig. 10.

3.03 Cable leaving office cable racks shall transition to the vertical plane at the cable pileup level as opposed to a diagonal line between the office cable rack and the equipment frame. Cable transitions (cabling between office cable racks and equipment frames) shall be in the form of an arc according to the minimum bending radius requirements of the cable(s) being installed. The weight of cable transitions shall be supported by the equipment frame's cable support apparatus rather than the horizontal cable and cable racks above the equipment frames. This shall be accomplished by applying an upward force to the transition cables before securing them to framework cable support apparatus (Refer to Fig. 10).

ISS. B, SECTION 800-003-150MP

3.04 At turns and junctions of horizontal cable racks where the turn of the cable is such that proper support for the cable is not provided by the cable rack straps, a 1/8 x 1-inch bar shall be placed diagonally across the rack similar to the method shown in Fig. 1. These bars shall be held in place by sewing with twine.

3.05 Supplemental cable supports as shown in Fig. 2 shall be provided when it is necessary to support runs of cable from inverted cable racks. Supplemental supports shall clamp the cables firmly without excessive distortion of the cable's basic shape. Space supplemental supports at approximate 10-foot intervals when the ultimate amount of cable is expected to be less than 100 square inches, and at approximate 6-foot intervals for ultimate cable amounts of 100 square inches or more.

3.06 Vertical cable runs 15 inches and wider extending through more than 2 floors shall be equipped with supplemental supports as shown in Fig. 3 or Fig. 4. Clamps shall be initially furnished and installed to accommodate the maximum cable pileup of the cable rack.

Straight Vertical Runs

- (a) Where the vertical runs are in exposed locations, one set of clamps shall be installed per floor located near the ceiling as shown in Fig. 3.
- (b) Where the vertical runs are located in shafts or other enclosures, two sets of clamps shall be installed per building floor, one just above the floor cable hole sheathing and the other about half the distance to the ceiling as shown in Fig. 4. The upper clamp shall not be less than 7 feet from the floor. Cables shall be sewn to cable racks immediately above each clamp, and banded as necessary between clamps to keep cables in an orderly fashion.
- (c) Clamps are not required if straight vertical cable runs are sewn at every cable rack cross strap.

Cable Rack Spirals

- (d) If the vertical run turns to a horizontal plane near the ceiling of the floor below the spiral, a clamp shall be installed immediately above the spiral as shown in Fig. 8(A).
- (e) If the vertical run turns to a horizontal plane immediately above the spiral, the clamp shall be installed below the spiral as shown in Fig. 8(B)
- (f) If the spiral is in a straight vertical run that continues the distance between two or more floor lines in both directions, a clamp shall be installed directly above and below the spiral as shown in Fig. 8(C).

B. Power Cable

3.07 Power cable No. 00 and larger turning upward from a horizontal to a vertical rack shall be installed on cable racks having a 45 degree incline at the turn. If the uninterrupted cable rise exceeds two floors the cross strap(s) in the inclined portion of the cable rack turn, and the first strap before the turn on the horizontal rack shall be covered with at least two layers of fiber protection.

3.08 Vertical power cable runs should be limited to three floors. If a power cable run is to exceed three floors, a horizontal cable run of at least 20 feet shall be introduced into the vertical cable

run at intervals not exceeding three floors. This may be accomplished by using vertically offset cable paths in the general direction of any horizontal travel, or by the introduction of a horizontal cable loop if the same vertical path (in-line cable holes) must be used.

4. Unsecured Cable

4.01 Cable on horizontal racks (including inclines up to 45 degrees) equipped with cable retaining apparatus need not be otherwise secured except where cables exit the racks. Where cables turn off of a cable rack they shall be sewn to other cables so they are held securely in place. Refer to 3.03. Cables placed on ladder type horizontal racks shall be provided with approved pans to provide cable support across rack straps. Pans shall be installed so no space exists between pan sections.

4.02 Unsecured cable shall be placed in an orderly manner and lie reasonably flat across the entire width of cable racks. To minimize the height of cable pileups at cable rack intersections, unsecured cable shall not be installed in bundles or concentrated groupings.

5. SECURED CABLE

A. General

5.01 Secured cable shall be placed on office cable racks in a layered fashion across the cable rack's width. The overall width of all cable installed on a cable rack shall be at least 1 inch less than the width of the supporting cable rack to allow room for attachment hardware along the sides of the cable rack stringers. As shown in Fig. 9, a minimum of 1/2 inch of horizontal space shall be maintained along both sides of cable racks for attachment hardware.

5.02 For the purposes of this part the word secure and its various forms refers to the firm or steadfast attachment of cable to a supporting member. The word band and its various forms refers to the attachment of one unit of cable or wire to another. Refer to TP76300MP for the acceptable methods of securing and banding network cabling.

B. Securing With Twine

5.03 Except as allowed in part 5(C), 9-ply waxed polyester twine shall be used to secure cable and wire in network facilities. A minimum of two strands of twine shall be used to secure cable to support structures such as cable racks and cable brackets, to band runs of small diameter cable and wire into larger units, and to band new to existing cables for installation uniformity purposes.

5.04 A minimum of 4 strands of twine shall be used to secure cable to inverted cable racks. 4 strands of twine shall also be used for cable securing and banding when it is apparent that the use of 2 strands will unduly deform the general shape of cable.

Copper Cable In General

5.05 Cable installed on horizontal and inclined cable racks shall be secured at every 3rd strap. At turns the cable shall be secured at closer intervals as necessary to maintain its position on the rack and to prevent cable bulge and sag.

5.06 All cable installed on inverted cable racks shall be secured at every strap and the cable rack shall be equipped with supplemental cable supports as covered in 3.05.

ISS. B, SECTION 800-003-150MP

- 5.07 Cables on vertical cable racks that do not pass through more than two floors, and all cable installed on cable rack spirals shall be secured to cable racks at every cross strap. Vertical cable runs extending through two or more floors shall be secured to cable racks at alternate straps and the cable racks shall be equipped with supplemental supports in accordance with 3.06.
- 5.08 Refer to Refer to TP76300MP for information regarding the number of cables permitted in a single cable stitch or band.

Power Cable

- 5.09 Horizontal power cable runs No. 0 and larger shall be secured to cable racks at alternate straps. Horizontal power cable runs smaller than No. 0 and armored cable runs shall be secured at every cable rack strap to prevent cable sag. It is acceptable to band small diameter power leads to approximate the size of a larger power conductor for inclusion under a single stitch provided that the conductor pairing requirements for power cable and conductors is not compromised.
- 5.10 Vertical power and armored cable runs, and inverted horizontal power cable runs shall be secured at every cable rack strap except as covered in 3.06(b).

Fiber Optic Cable

- 5.11 Unless otherwise specified, fiber optic cables shall only be tied or otherwise fastened to their supporting apparatus to the extent necessary to restrict cable movement. Cable stitching shall be such that the cable jacket/insulation of fiber optic conductors is not deformed. With the use of slight force it should be possible to move fiber optic cables within their cable stitches.

C. Securing With Nylon Cable Ties

- 5.12 Nylon cable ties may be used instead of twine for:
- (a) Securing and banding of copper cables, other than soft centered coaxial cables, to the cable support apparatus of equipment frameworks except at the cable's initial point of support in a frame or cabinet. Cable shall be secured with twine at its first point of support upon entering a frame or cabinet.
 - (c) Banding of transition cables between office cable racks and the top of equipment frames.
 - (d) Securing of copper cable, other than soft centered coaxial cables, to miscellaneous cable support apparatus. Cable added to existing miscellaneous cable support hardware shall be secured using the same materials and methods used initially.

6. PROTECTION

A. General

6.01 Cable shall be protected from abrasion where it bends around or comes in contact with the edges or corners of metal objects such as auxiliary framing, threaded rods, cable rack components, or movable parts or equipment (hinged, retractable, etc.). Generally, cable protection should be applied to the objects or surfaces the cable is being protected from, however, cable protection may be applied around the cable itself when it is more appropriate to do so.

6.02 1/64-inch thick sheet fiber (vulcanized fiber, fish paper) shall be used in general to protect cable from abrasion. Tape may be used for abrasion protection only within the confines of network equipment frames when the use of sheet fiber is not practicable. Twine shall be used to hold sheet fiber in place around metal objects and cable located in the office overhead ironwork environment.

6.03 Sheet fiber or 3/4" I.D. thin wall PVC tubing shall be installed on all threaded rods that are within 1-inch of network cabling, and the support rods of hung cable rack. The length of installed threaded rod protection for hung cable racks shall be a minimum of 16-inches for support rods longer than 16-inches (12" pileup +2"). Protection shall be applied the entire length of support rods less than 16-inches in length.

6.04 The cable protection products listed in Table C are acceptable for use in network facilities. Except for tape products which are installer furnished items, cable protection products should be provided as part of the equipment engineering process using the application guidelines listed.

TABLE C	
PRODUCT	GENERAL APPLICATION
* P068616 Fiber Protection (34" Long)	Cable rack cross straps - Furnished at all in-line turns and vertical offsets in horizontal cable rack runs, and where cable is to drop through a cable rack rather than over its stringers. Alternative is sheet fiber.
* P32B952 Insulator (7-3/4" Long)	Edges of 3/8" thick metal - Furnished for cable racks above all new equipment frames and cable rack runs intersecting at different levels. Alternative is sheet fiber.
* 995524170 PVC Tubing (33" Long x 3/4" I.D.)	5/8" hanger rods - Furnished for all hung cable racks, and cable rack offsets using threaded rods. Alternative is sheet fiber.
* 995831013 Fiber Protection (48 x 48 x 1/64" sheet)	Protection in general - Furnished when deemed appropriate for large cable and cable rack installation jobs.

* Denotes an AT&T Technologies material ordering identifier.

7. CABLE REMOVAL

7.01 Cable is *removed* or *mined* from office cable racks. This part covers the requirements for removing cable that is made inoperative. For the purposes of this part the term "cut-dead

ISS. B, SECTION 800-003-150MP

cable" is used to reference all cable and wire made inoperative by the removal or rearrangement of equipment frames, units, or circuits on a given work order. Cable mining is defined as the extensive disturbance of installed cables to access and remove cut-dead cables that are buried by working cable. TP76300MP is the reference document for cable mining work activities.

7.02 Cut-dead cable shall be removed from office cable racks as far as possible without mining.

Ordinary cable removal activity includes the minor disturbance of unsecured cable runs, and the removal and replacement of cable stitching for the top two layers of secured cable runs to access cut-dead cables. Cable removal activity applies to cable passing through fire stopped cable holes and cable installed under raised floors of equipment areas.

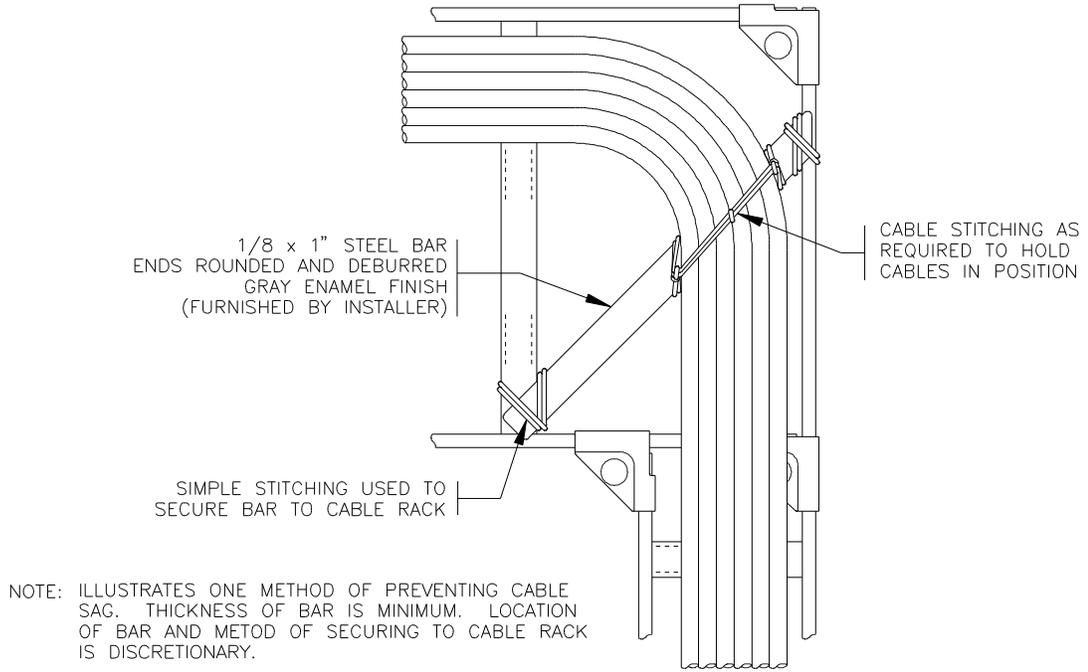
7.03 The ends of cut-dead cables that are not removed from office cable racks shall be relatively flat and sufficiently wrapped with electrical or insulating tape so the ends are not a hazard to people or other cables.

8. REFERENCES:

Figure	Paragraph
1	3.04
2	3.05
3	3.06, 3.06(a)
4	3.06, 3.06(b)
8A, 8B, 8C	3.06(d), 3.06(e), 3.06(f)
9	5.01
10	3.02. 3.03

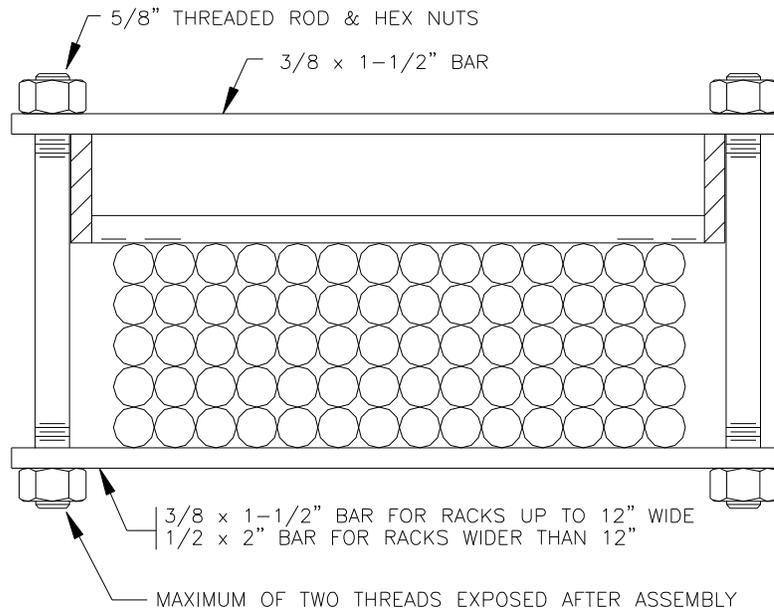
TABLES:

- A Permissible Penetrating Items in Circular and Small Rectangular Openings For Intumescent Fire Stopping Applications
- B Permissible Penetrating Items in Circular and Small Rectangular Openings For Expandable Foam Applications
- C Cable Protection Products List and General Application



Additional Cable Support To Prevent Cable Sag

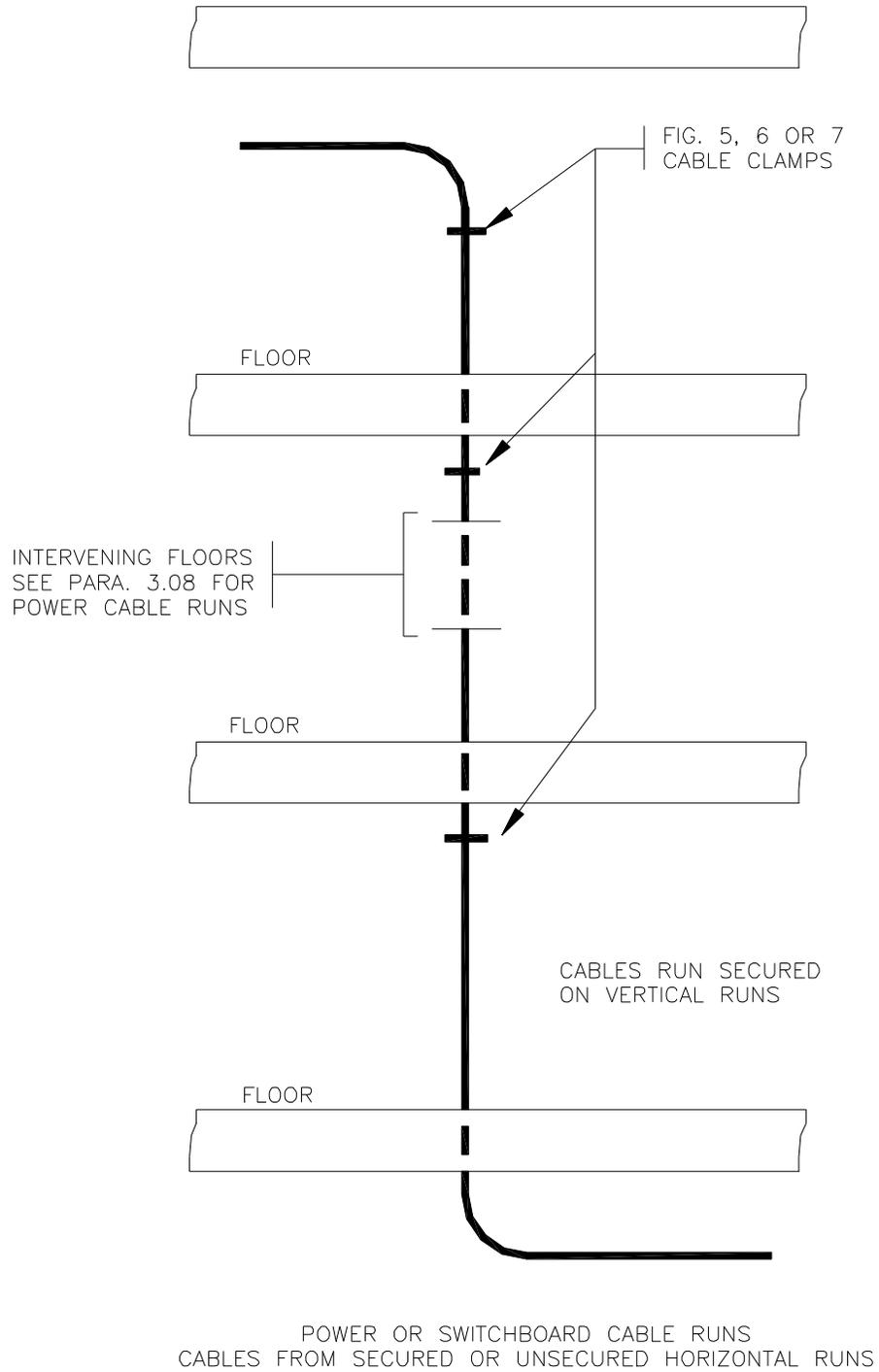
Fig. 1



NOTE: THREADED RODS TO BE REPLACED WITH LONGER RODS WHEN ADDITIONAL CABLE IS INSTALLED, OR RODS WHICH WILL ACCOMMODATE THE ULTIMATE CABLE PILEUP MAY BE PROVIDED INITIALLY IF TEY ARE EQUIPPED WITH GUARDS AS SHOWN IN FIG.5.

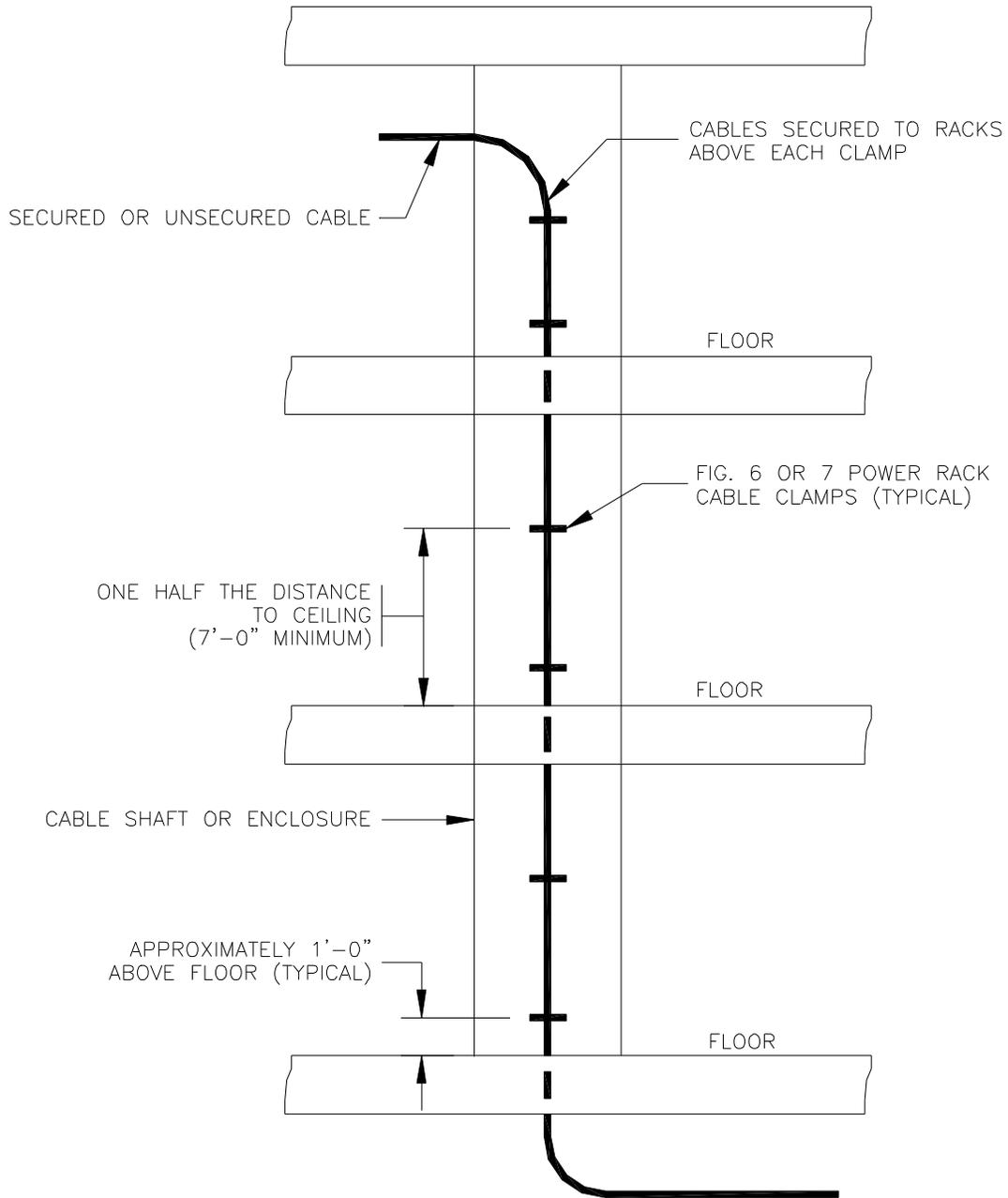
Auxiliary Support For Inverted Horizontal Cable Runs

Fig. 2



Location Of Supplemental Cable Supports For Vertical Runs In Exposed Locations

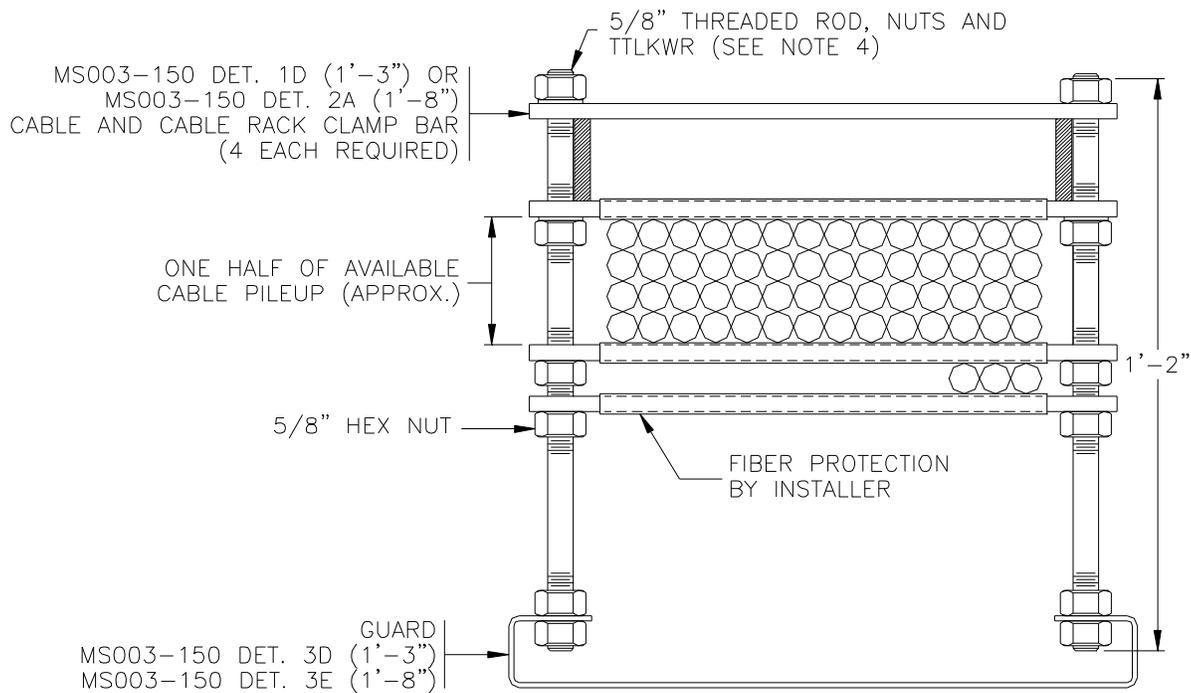
Fig. 3



NOTE: CABLE CLAMPS ARE NOT REQUIRED ON VERTICAL RUNS WHICH ARE SECURED TO CABLE RACKS AT EVERY CROSS STRAP

Location Of Supplemental Cable Supports For Vertical Runs In Cable Shafts And Other Enclosures

Fig. 4

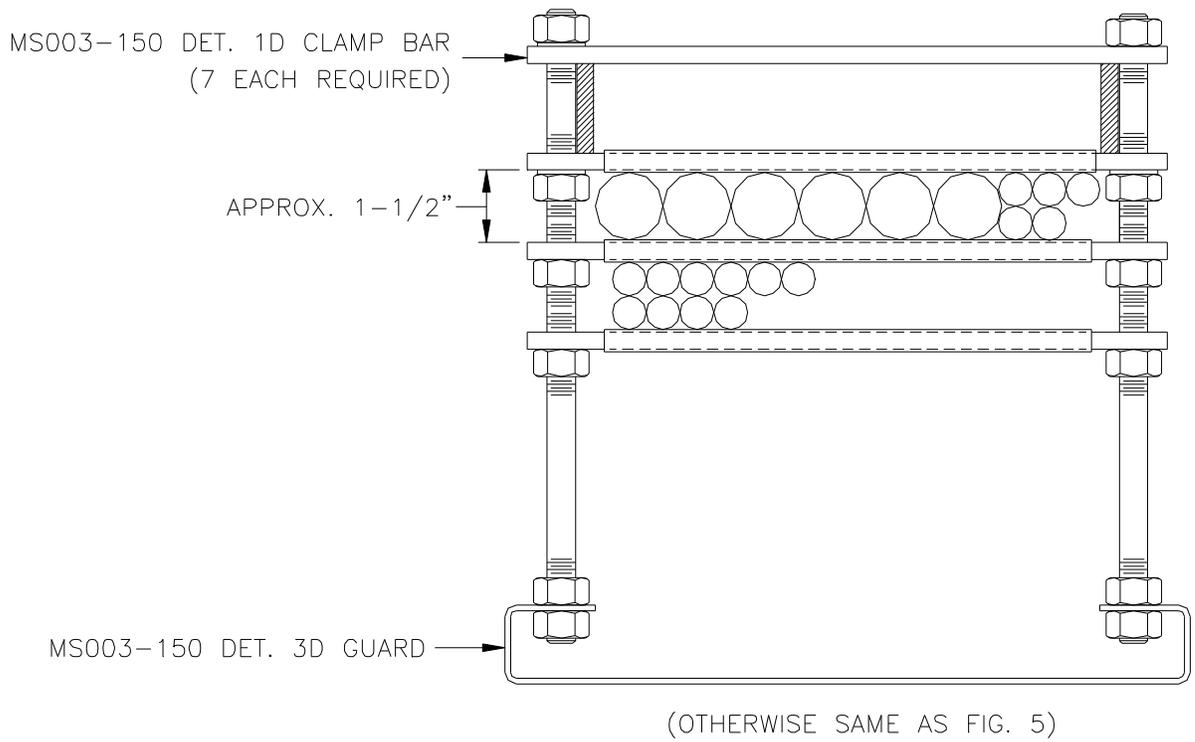


NOTES

1. UNUSED CLAMP BARS AND HEX NUTS SHALL BE ASSEMBLED ON THREADED RODS FOR USE WITH FUTURE LAYERS OF CABLE
2. FIBER PROTECTION SHALL BE APPLIED TO CABLES WHERE CONTACT WITH NUTS OR THREADED RODS CAN NOT BE AVOIDED.
3. LOCATE CLAMPS 1 TO 1-1/2 INCHES FROM CABLE RACK CROSS STRAPS.
4. THREADED RODS SHALL BE CUT APPROXIMATELY FLUSH WITH NUTS AT THE BACK
5. CLAMP BARS SHALL HOLD CABLES FIRM WITHOUT EXCESSIVE DEFORMATION OF CABLES.

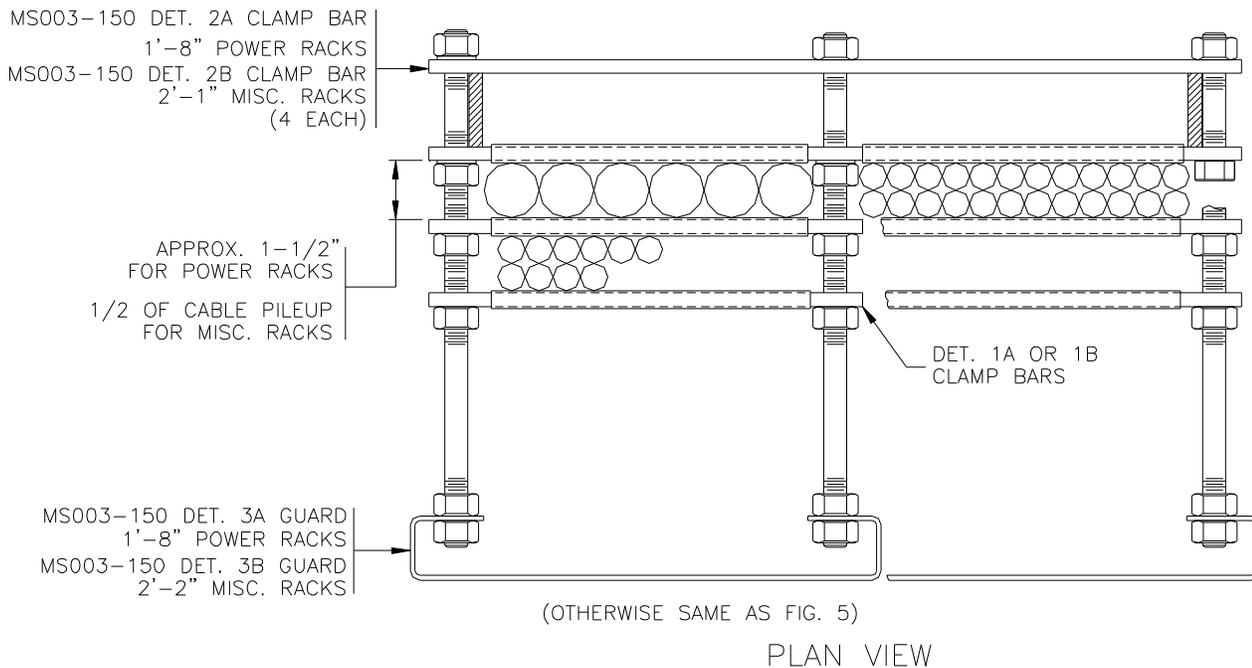
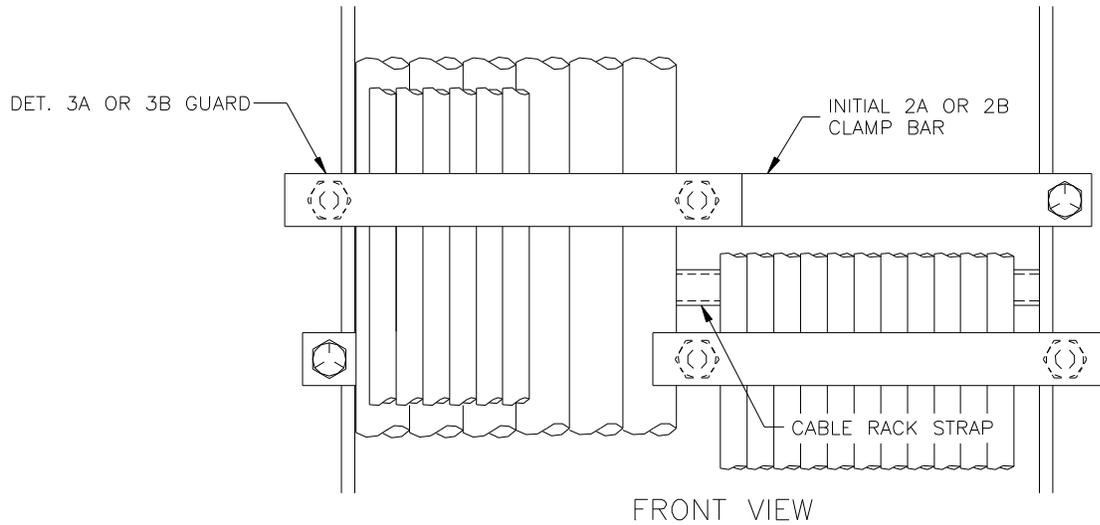
Supplemental Vertical Cable Support For
Miscellaneous Cable Racks 1'-3" and 1'-8" Wide

Fig. 5



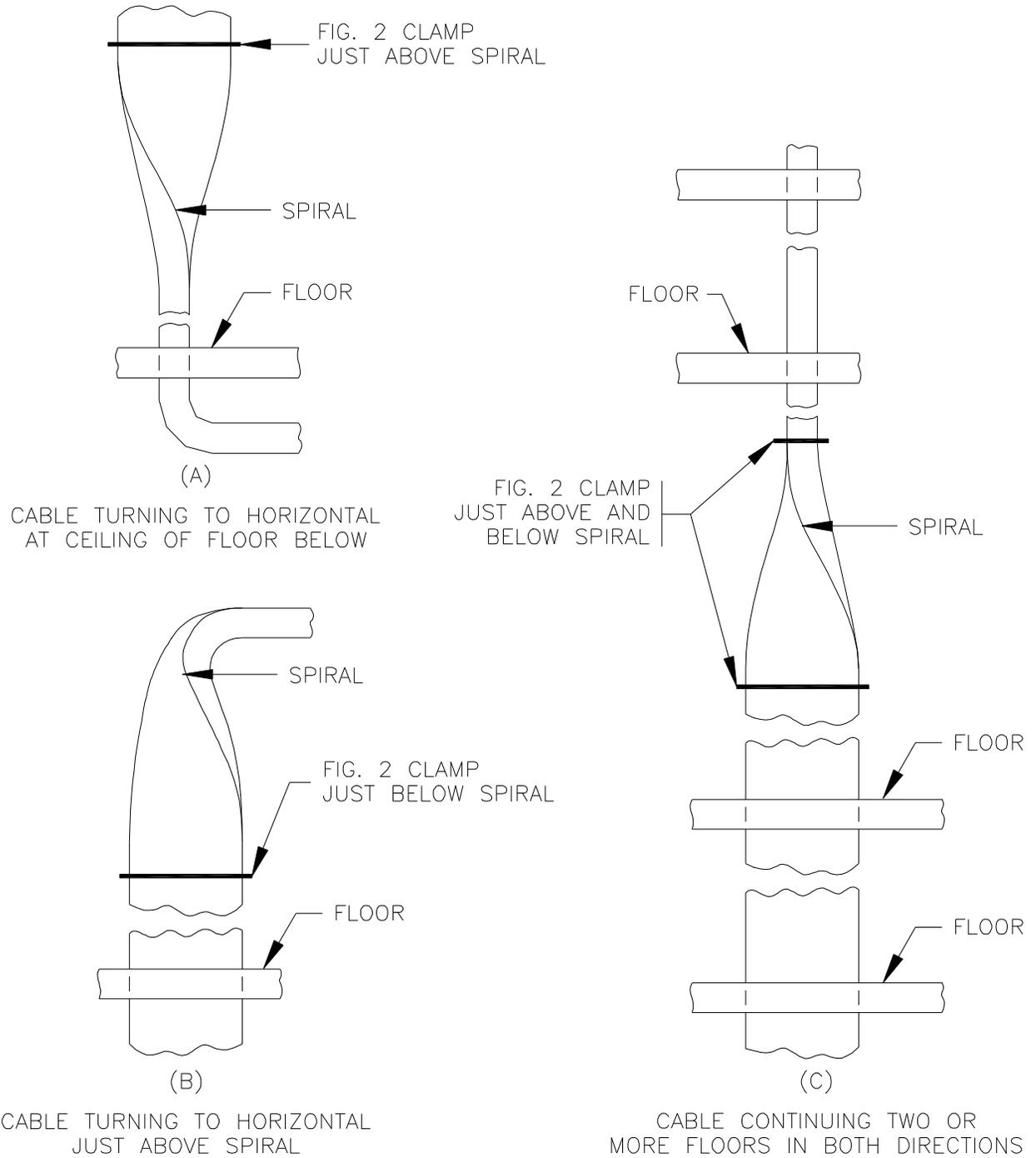
Supplemental Vertical Cable Support For
1'-3" Wide Power Cable Racks

Fig. 6



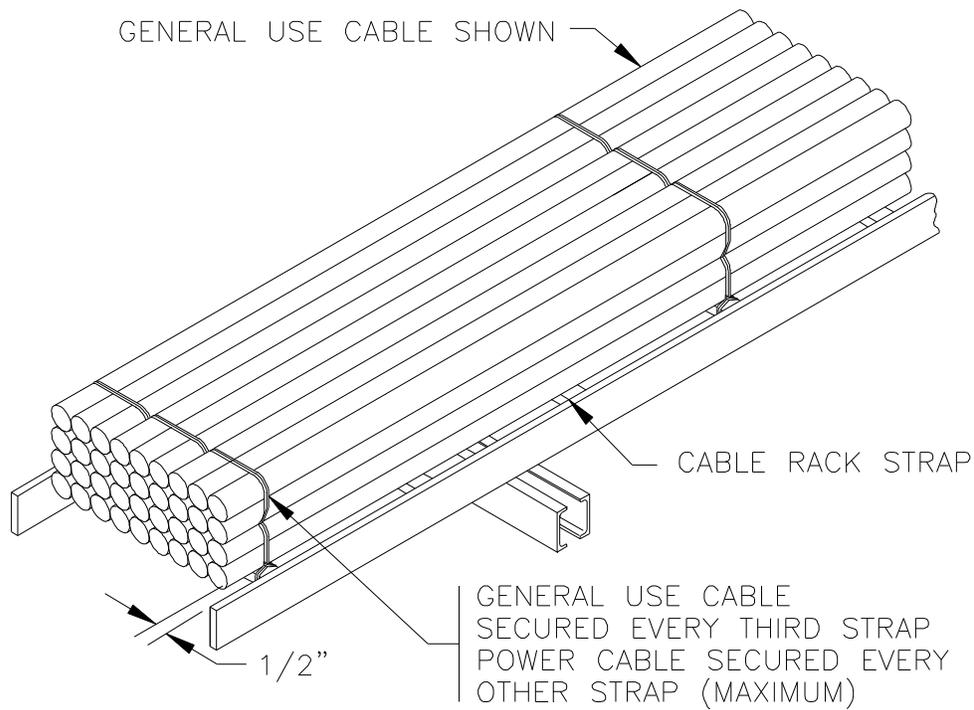
Supplemental Vertical Cable Support For
1'-8" Wide Power Cable Racks And 2'-1" Miscellaneous Cable Racks

Fig. 7



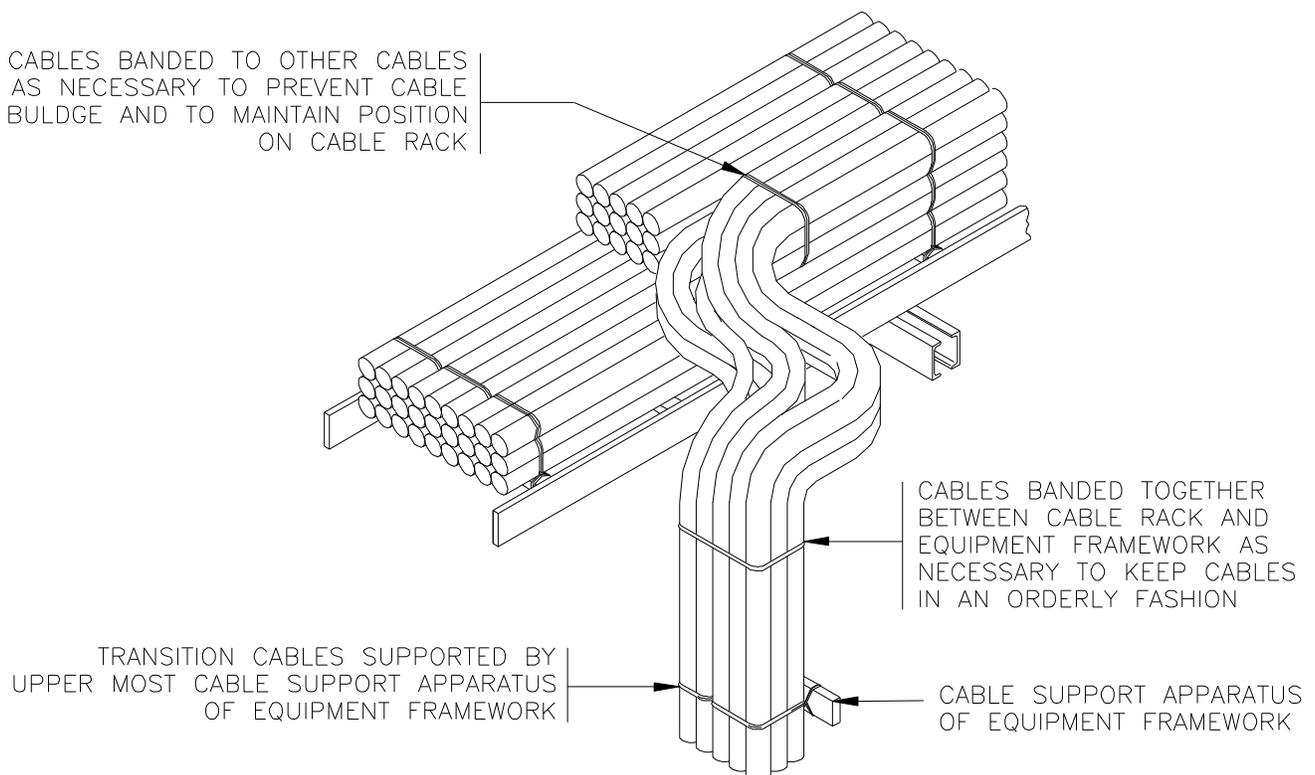
Location Of Supplemental Cable Supports For Spiral Cable Runs

Fig. 8



Location Of Cable Securing Stitches On Office Cable Racks

Fig. 9



Supporting Cable Transitions Between Office Cable Racks And Equipment Frames

Fig. 10